

Process Overview

Steam is used in several areas throughout the plant. It is the driving force for the heat of separation in the Distillation Columns. It is also used for cleaning and sterilization of tanks, lines and vessels.

The Steam System is a chemically treated, closed loop system. Steam that has expended its thermal energy is returned to the boiler in the form of steam condensate. Steam condensate differs from process condensate in that steam condensate is in a controlled, closed loop process, whereas process condensate is hot water reclaimed from various steam generating processes. Boiler condensate to the boiler saves water and energy and maximizes the effectiveness of the chemical additions made to enhance water quality.

Boiler feed water is treated with chemicals to prevent boiler and system corrosion and to prevent foaming which can cause droplets of water to carry over into the steam supply. Boiler Feed water Treatment should be undertaken with the care and cooperation of the process water treatment vendor.

The Package Boilers are large energy users and must be properly maintained by the manufacturer's instructions to ensure an efficient, productive processing plant.

Package Boilers

Two natural gas-fired, 75,000lbs/hr, Model 8-5-11000-S150-WB-G, Package Boilers, Z-7201A, Z-7201B, supplied by Superior Boiler Works, Inc., are configured in a lead and lag control scheme. The Boilers are sized so that both Boilers firing at 80% provide all the required plant steam production when the process is operating at full capacity. The lead boiler can be operated at 90% with the lag boiler at 60% in an alternating approach. The loss of one Boiler for any reason requires a corresponding reduction of production though put. Loss of both Boilers at the same time will result in a complete Plant shutdown.

Boiler Feed water

Three Boiler Feed water Pumps take suction from the Deaerator, Z-7202 and deliver the feed water to the Boilers. Normal configuration is to have two feed water pumps in service and have one in reserve. The Deaerator is fed by a combination of returning high temperature condensate from Steam Condensate Return and makeup water. This water is fed to the vessel in sufficient quantity to make up for any loss due to leaks; maintaining a constant level greater than 50%.

Chemical Treatment

The Walchem Boiler Controller Model WBD300-125 is used to maintain all boiler water treatment chemicals and boiler blow down. Information on boiler chemicals and delivery systems can be found in water treatment.

Critical Controls/Values

Deaerator level is the single most critical operating parameter for this system. An individual boiler can shutdown or trip out of service from low water level, main burner flameout or loss of fuel gas flow. Restricted or lost makeup water flow or condensate return flow are the primary causes for this situation and should be avoided if at all possible. Gas firing and Boiler Feedwater Level for each Boiler are set and controlled locally by the level control on each boiler. Steam pressure and flow to the supply header for each Boiler are automatically controlled by the boiler management system and has the hardware capability of communicating with the distribution control system. Deaerator level is alarmed and the shutdown is indicated on the DCS.

Safety

- Steam and steam condensate burn exposed skin. Avoid direct exposure to steam vapors and condensate liquid. Wear personal protective equipment when sampling condensate.
- The elevated pressure of steam can cause personal injury. Keep all body parts out of the way of open steam flows.
- Incorrect operation of Boilers can lead to high pressure failure of boiler tubes and parts causing personal injury. Ensure you follow manufacturers instructions.

BOILER MAINTENANCE

DAILY: inspection rounds are made each hour minimum and results recorded on log sheet. LWCO, columns and gauge glass are blown at the beginning of each shift. (LWCO shunt switch is used to prevent the boiler from shutting down and interrupting production. Actual shut down test is performed frequently when plant operation permits) Boiler water chemistry tests are performed each day and water treatment is adjusted per operating parameters as is blown down

Semi annual: Boiler is taken down and opened up for inspection of fireside and water sides. At this time the safety relief valves are tested also by resetting the the limits and actually testing the set pressure. The high pressure switch is also calibrated at this time. (with a pressure calibrator, not just the idicating bar) Should it deem nesscary combustion testing and reseting of combustion will be performed on a semi annual basis also. as the boiler in the "heart" of plant operation, maintenace is diligently performed to assure safe and efficent operation.

Annual: to comply with Minnesota state law, once each year the boilers will be inspected by the appropriate certified boiler inspector.



3524 East 4th St.
Hutchinson, KS 67501
Phone (620) 662-6693
Fax (620) 662-7586
www.superiorboiler.com

OPERATION AND MAINTENANCE INSTRUCTIONS

DAILY PROCEDURE

1. Blow primary LWCO down while burner is firing. Verify that feedwater pump cycles normally and that burner shuts off.
2. Observe burner starting sequence and flame characteristics to verify normal behavior. Check furnace for debris and sooting, also inspect refractory through flame.
3. If operating log is kept, enter reading; otherwise, conduct visual check of all pressure and temperature gauge readings.
4. Check safety valves, handholes and manway for signs of leakage.
5. If boiler is firing oil, check level in oil storage tank. If burner has an atomizing air compressor, check its lubricating oil level.
6. Check stack temperature. If temperature is higher than normal, check burner operation for overfiring or improper combustion.
7. Check temperature of water supplied to unit and if below 140 °F preheat return to about 165 °F.
8. Check water sample readings for proper chemical treatment.
9. Perform bottom blowdown at an interval set by Chemical Representative.

WEEKLY PROCEDURE

1. Check combustion control operation as outlined in check list section of service manual. Investigate and correct at once any failure.
2. Check the pressure limit shutdown. During this check, observe the operation of the programming control to make sure that the operation is as described in the sequence of operation section of the service manual.
3. Wipe the entire unit, particularly the operating parts, so that oil and dust do not accumulate.
4. If firing heavy oil, clean oil nozzle as detailed in burner manufacturer's instructions. Nozzle and electrode setting must be returned to original adjustments.
5. Check chemical feed equipment against check list supplied by water treatment company. Treatment should be introduced

directly into the boiler or device located on discharge side of the feedwater pump.

6. Check auxiliary LWCO to verify that it shuts burner off.

MONTHLY PROCEDURE

1. Clean feedwater strainer between the pump and the condensate return tank.
2. Clean the air intake filter on the atomizing air, if air compressor is present. Replace filter oil with clean compressor lubricating oil.
3. Clean combustion air fan and air inlet assembly.
4. Check rear door for flue gas leaks and tighten bolts as required. Tighten bolts evenly - uneven tightening could cause leakage.
5. Check air flow and fuel pressure switches.
6. Manually blow boiler safety valves.
7. Clean scanner lens.

IF BURNER DOES NOT START CHECK FOR CONTROLLER FAULT CODE

1. Check all electric fuses.
2. Check water level in boiler.
3. Check limit controls to make sure they are making circuit.
4. Push motor or starter reset button.
5. Push reset button on the programming control.
6. Push reset on high and low gas pressure switches.
7. Push reset button(s) on LWCO and temperature devices.
8. If burner then fails to start, call a qualified service technician.

TO STOP BURNER

1. Switch off burner control switch or push emergency door switch.
2. Do not pull feedwater pump switch until boiler is cooled.

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ANNUAL PROCEDURE

SEMI-ANNUAL PROCEDURE

1. Cool boiler slowly to room temperature. (110 °F minimum) **NOTE:** Failure to cool boiler slowly will possibly cause tubes to leak. This is very important! To assist cool down, use the Test/Run or Check/Run switch located on the programmer to run the blower.
2. Remove all the nuts and clamps around the front door flange, pry the door loose from the boiler and swing it away on the davits.
3. Using the flue brush and vacuum cleaner, brush through the tubes to the rear end of the boiler.
4. Soot and scale may be removed from the rear end of the boiler by removing the cleanout plug located at the bottom of the rear door and inserting vacuum cleaner hose. (Does not require large door to be opened.)
5. Check the rear door refractory and patch any cracks or spalled areas with high temperature cement. Refractory may be obtained from the factory.
6. Always replace the 1" ceramic fiber seal around the edge of the rear refractory with a new seal when rear door is opened and gasket is damaged.
7. Tighten front and rear door nuts evenly to take up any slack created through drying out.
8. Clean the peep sight glass or replace if required.
9. Flush air compressor as directed in service manual.
10. If boiler is used for a steam process with a high percentage of feedwater makeup, follow the Annual Procedure Items 2 & 3.
11. Clean & Adjust pilot Assy.

1. Follow steps 1 through 10 listed under Semi-Annual Procedure.
2. Clean water side of boiler as follows:
 - Open upper tri-cocks and any other available vent valves to prove that the boiler contains no steam.
 - Drain the boiler through the blowdown valve. Start washing down tubes ASAP.
 - Wash down the inside (water side) of the boiler with a hose, making sure to get all sludge and scale out of bottom of boiler.
 - Remove all handhole covers and the manhole cover.
 - Inspect shell and tube surfaces for signs of corrosion or scale formation. If scale is forming (to any degree) on internal surfaces, chemical treatment is not correct. Consult chemical supplier.
 - Remove plugs from low water cutoff equalizer crosses and rod piping if scale is present. Remove low water cutoff head and clean float chamber. Reassemble with new gasket.
 - Using new gaskets, install the handhole covers and manhole cover.
 - Disconnect the piping on the discharge side of the feedwater pump and inspect for scale build up. Check stop and check valves for proper operation and replace if necessary.
 - Install new safety valves of proper pressure and capacity rating. If the safety valves have not been tested. Old valves may be refurbished by a reputable valve repair company in possession of a VR stamp and kept as spares.
 - Fill the boiler by means of the feedwater pump and reset the low water cutoff.
3. At the time of this yearly inspection and cleaning, it is recommended that the local State or insurance inspector, in addition to the SUPERIOR distributor, or agent, be called in to check the condition of the equipment. Chemical supplier should also be present.

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